REMARKS

Claims 1-25 and 29-53 and 55-58 are now pending in the application. Applicants have amended claims 1 and 55. Applicants submit that the amendments to the claims contained herein are supported in the specification as currently disclosed. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 112

Claims 1-22 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter which Applicant regards as the invention. This rejection is respectfully traversed.

In view of currently amended claims 1 and 55, Applicants submit that the Examiner's objections to the recited limitations "non-ferrous" metal oxide composition and "…in direct contact with said electrode…" are moot. Claims 1 and 55 have been amended to recite a "doped metal oxide" composition "…in electrical communication with said electrode…" Applicants submit that paragraphs [0073], [0115], and [0120] provide support for a doped metal oxide composition. Applicants further submit that paragraphs [0066], [0070], and [0073] disclose a doped metal oxide coating in electrical communication with an electrode of a membrane-electrode-assembly.

Accordingly, reconsideration and withdrawal of the Examiner's rejections of claims 1-22 are respectfully requested.

REJECTION UNDER 35 U.S.C. § 102

Claims 1, 3, 13, 15, 18-21, 55, and 58 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Li et al. (U.S. Pat. No. 5,624,769). This rejection is respectfully traversed.

In view of currently amended claims 1 and 55, Li et al. does not disclose an electrical contact element having a doped metal oxide coating exhibiting a bulk resistance of less than 1 ohm-cm. As best understood by Applicants, Li et al. discloses a titanium nitride (TiN) topcoat applied over a barrier/protective layer of stainless steel deposited on the core of the bipolar septum/plate. Due to microdiscontinuities in the TiN topcoat, discrete portions of the barrier/protective layer are exposed to the fuel cell environment and may corrode to form oxide deposits on the barrier/protective layer. Additionally, the TiN layer may corrode, forming titanium oxide deposits on the topcoat layer. Neither of these oxide deposits is a metal oxide layer that has been doped (e.g. with fluorine) to achieve the claimed conductivity. Additionally, these oxides, where present, produce areas of high contact resistance that are detrimental to the proper operation of a fuel cell. Specifically, oxides of stainless steel and titanium that form in the environment of a fuel cell typically have electrical contact resistance values of around 250 milliohms/cm^2. In contrast, the doped metal oxides disclosed by Applicants have electrical contact resistance values of around 10-12 milliohms/cm^2 (see paragraph [0084]).

Li et al. also does not disclose a metal oxide coating which forms a layer or topcoat on the major surface of the electrically conductive contact element. In Li et al., the oxides that form on the barrier/protective layer form in spots at discrete locations

coinciding with discontinuities in the TiN topcoat layer, rather than forming a layer spread over the major surface of the contact element as claimed by Applicants. Similarly, the oxides of titanium that can form on the surface of the TiN topcoat layer form in spots coinciding with localized titanium.

For the reasons set forth here, Applicants submit that claims 1, 3, 13, 15, 18-21, 55, and 58, as currently amended, are allowable under § 102(b). Therefore, reconsideration and withdrawal of the rejection of claims 1, 3, 13, 15, 18-21, 55, and 58 are respectfully requested.

At least claims 1 and 55 stand rejected under 35 U.S.C. §102 (e) as being anticipated by Gyoten et al. (U.S. Pat. No. 7,005,205). This rejection is respectfully traversed.

In view of currently amended claims 1 and 55, Gyoten et al. does not disclose an electrical contact element having a doped metal oxide coating exhibiting a bulk resistance of less than 1 ohm-cm. As best understood by Applicants, Gyoten et al. discloses an electroconductive resin layer containing powders of metal oxide, such as Ru-oxide, disposed on a metal substrate, such as stainless steel or aluminum. Gyoten et al. also discloses a passivating metal or oxide layer disposed between the metal substrate forming the core of the electrically conductive element and the electroconductive resin topcoat layer (see Col. 8, lines 18-22). Neither the powders of metal oxide, nor the intermediate metal or oxide layer disclosed by Gyoten et al. are metal oxide layers that have been doped (e.g. with fluorine) to achieve the claimed conductivity. Furthermore, any oxides that may form on the metal substrate or on the intermediate passivating metal layer as a result of exposure to the fuel cell environment

due to porosity in the electroconductive resin topcoat layer are also not doped metal oxides with low bulk resistance as claimed by Applicants. These oxides, which include oxides of iron, chromium, nickel, molybdenum, aluminum, zinc, tin, and tungsten have relatively high bulk resistance values (see Col 8, lines 40-41). Additionally, these oxides, where present, produce areas of high contact resistance that are detrimental to the proper operation of a fuel cell. Unlike the doped metal oxides disclosed by Applicants, which have electrical contact resistance values of around 10-12 millohms/cm^2 (see paragraph [0084]), these oxides typically have contact resistance values on the order of 250 milliohms/cm^2.

For the reasons set forth here, Applicants submit that claims 1 and 55, as currently amended, are allowable under § 102(b). Applicants submit that all claims that depend from claims 1 and 55 are allowable under § 102(b) for at least the same reasons. Therefore, reconsideration and withdrawal of the rejection of claims 1 and 55, along with the claims that depend from them, are respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Claims 2, 14, 22 and 56-57 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al. (U.S. Pat. No. 5,624,769) in view of Gordon (U.S. Pat. No. 4,146,657). This rejection is respectfully traversed.

As previously argued herein, Li et al. does not disclose an electrical contact element having a doped metal oxide coating. Furthermore, Applicants respectfully submit that it is improper to combine Gordon with Li et al. to cure this deficiency, for the following reasons. Gordon does not suggest the desirability and thus, the motivation,

to apply a film of tin oxide to the unique environment of the fuel cell disclosed by Li et al. Gordon discloses electrically conductive films of tin oxide that are also characterized by extremely good visible transparency and infrared reflectivity, but does not disclose other necessary properties of the oxide films that would render them useful to a bipolar plate in a polymer-electrolyte-membrane (PEM) fuel cell, such as corrosion resistance, hydrophylicity, and electrical contact resistance. These material properties vary greatly among metallic oxides and render many, if not most, metallic oxides unfit for fuel cell applications.

Applicants also submit that one skilled in the art of designing fuel cells would have no reasonable expectation of success in combining Gordon with Li et al. to improve upon fuel cell designs. Gordon teaches the desirability of applying fluorine doped tin oxide films to the silica-based substrates found in solar cells and semiconductors used in electrical circuitry due to their disclosed benefits of visible transparence, and infrared reflectivity. Unlike both of these applications, PEM fuel cell applications present substantial problems with corrosion due to the presence highly acidic solutions, anodic and cathodic dissolution, and hydrogen embrittlement due to exposure to pressurized hydrogen.

Gordon discloses a process that improves the fabrication of a solar cell by describing a method of obtaining a doped metal oxide layer on heated glass substrates without the fogging of the glass substrate associated with other processes. Gordon describes thirteen examples of such a process, and in each example, the substrate is formed of either a pyrex glass plate or a silicon substrate. None of the examples discloses a process for forming a doped metal oxide layer on a metal substrate, such as

those used in the bipolar plate of Applicants' invention. Additionally, while Gordon discloses the conductive nature of doped metal oxide compositions applied by his method, Gordon does not discuss the resulting bulk resistance or the contact resistance values *between* the doped metal oxide layer and underlying substrate. Unlike the films applied to glass substrates used in the photoelectrochemical cells and other applications mentioned by Gordon, the doped metal oxide coatings applied to the metal substrate of a bipolar plate in a fuel cell must be able to efficiently pass electrical current to and from the substrate. Therefore, low contact resistance values, in addition to the low bulk resistance values disclosed by Gordon, are important to films used in the bipolar plate of a PEM fuel cell.

For the reasons set forth here, Applicants respectfully submit that claims 2, 14, 22 and 56-57 are in condition for allowance. Accordingly, reconsideration and withdrawal of Examiners rejections of claims 2, 14, 22 and 56-57 are respectfully requested.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the

Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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